

# PATENT ABSTRACTS OF JAPAN

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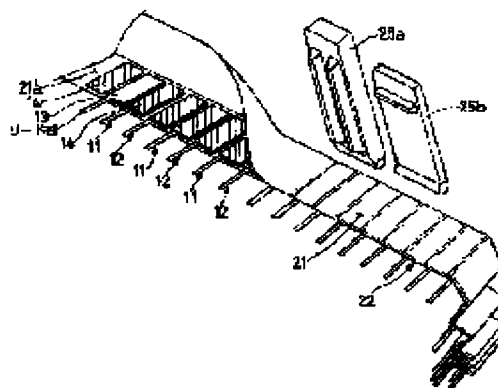
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## (54) ELECTRODE LAMINATE FOR ELECTRIC DOUBLE LAYER CAPACITOR

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve productivity and reliability of an electrode laminate by providing a structure where one long sheet-shaped separator seals a series of positive and negative electrodes, respectively, so as to wrap them, and the sealed electrodes are overlapped in zigzag fashion.

**SOLUTION:** In a stacking mechanism, in a status where a separator shifts in a downstream and is being doubly folded in a longitudinal direction, a positive electrode 11 and a negative electrode 12 are alternately formed, by stacking a polarizable electrode 14, a collecting electrode 13 and the polarizable electrode 14 successively on the inner side horizontal plane 21'a of the separator material folded substantially vertical by a holding mechanism. A heat-sealing machines 25 (25a and 25b) perform heat-sealing on the separator material to seal the series of positive electrode 11 and the negative electrode 12 with the separator so as to wrap respective electrodes. The heat-sealing machines 25 form a long storing body 22, which is formed by dividing the separator 21 by the heat-sealing parts by the positive electrode 11 and the negative electrode 12. A zigzag folding machine zigzag folds the long storing body 22 by each one division, cuts it when the number of the positive electrodes 11 and the negative electrodes 12 becomes a prescribed number, and an electrode laminate is obtained.



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**CLAIMS**

[Claim(s)]

[Claim 1]In an electrode layered product for electric double layer capacitors which makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, In [ said / which was folded up ] a separator of a long sheet shaped folded up by longitudinal direction, It is put into an anode and a negative electrode in the state where it was arranged by turns, and by a heat seal being given to said separator further An anode of the above [ this separator ], An electrode layered product for electric double layer capacitors which one is divided at a time for every negative electrode, and the aforementioned anode and a negative electrode are sealed, respectively where an electrode lead part is made to project from a separator, and turns up a long accommodation body of this anode of a series of and a negative electrode to the 1st division fraction [ every ] ZIG ZAG, and is characterized by things.

[Claim 2]The electrode layered product for electric double layer capacitors according to claim 1, wherein the aforementioned anode and a negative electrode arrange a polarizable electrode which becomes the both sides of a collector from activated carbon, respectively.

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[Translation done.]

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention about the electrode layered product which is the main components of an electric double layer capacitor, makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, it is an electrode layered product which laminates many anodes and negative electrodes by turns especially -- 100 electric capacity -- several -- the mass electric double layer capacitor (electric double layer capacitor for power) of 1000F -- it is related with the electrode layered product for electric double layer capacitors suitable as business.

[0002]

[Description of the Prior Art] As everyone knows, the electrical energy by the electric charge accumulated in the electric double layer formed in the interface of a polarizable electrode and an electrolysis solution is used for an electric double layer capacitor. In recent years, development of what is called a mass electric double layer capacitor (electric double layer capacitor for power) of low resistance is furthered with the large scale which is hundreds in which the large current discharging more than an ampere order is possible -- the number 1000F, and application for power uses, such as a power supply for motor drives, is advanced. What impregnated this with the electrolysis solution and stored the electrode layered product which makes a separator intervene among them and accumulates two or more anodes and two or more negative electrodes by turns as one of such the mass electric double layer capacitors in the square-shaped armor case is known.

[0003] Drawing 4 is a figure for explaining the composition of the electrode layered product for the conventional mass electric double layer capacitors.

[0004] An assembly of the conventional electrode layered product uses an industrial robot (graphic display abbreviation) with the robot hand to which many small adsorption pads were attached, and are the following (A). -- (F) It was carried out in the procedure. That is, pressure plate [ of one sheet ] P which makes a rectangle is laid on the pedestal which is not illustrated, and it is (A). The separator 15 of one sheet which makes the shape of a rectangular sheet next is layered. (B) Rank second, layer the polarizable electrode 14 of the rectangle thin plate state of one sheet, the collector 13 of one sheet of the shape of a rectangular sheet which has an narrow band-like lead part for external terminal connection, and the polarizable electrode 14 of one sheet as follows on this order, and form the one negative electrode 12. (C) Layer the separator 15 of one sheet on the polarizable electrode 14 of said negative-electrode 12 upper part. (D) Then, layer the polarizable electrode 14 of one sheet, the collector 13 of one sheet of the shape of a rectangular sheet which has an narrow band-like lead part, and the polarizable electrode 14 of one sheet as follows on this order, and form the one anode 11. About the collector 13, as it is indicated in drawing 4 and drawing 5 as the thing for anodes, and the thing for negative electrodes, it laminates so that the lead part for anodes and the lead part for negative electrodes may not lap and it may become a position of right-and-left reverse.

[0005] (E) Rank second and it is the above (A). -- (D) The number of necessary times repeats a procedure. For example, it laminates at a time by turns [ 20 ] the negative electrode 12 and the

anode 11 via the separator 15. (F) And layer the separator 15 of one sheet on the polarizable electrode 14 of the anode 11 upper part arranged on the outermost part. Such is carried out, the electrode layered product 50 (refer to drawing 5 (a)) which makes the separator 15 intervene among them and laminates the anode 11 and the negative electrode 12 of a required number by turns is assembled, finally pressure plate [ of one sheet ] P is layered, and an assembly is ended.

[0006] Said polarizable electrode 14 adds first granular phenol resin and the solvent for phenol resin distribution which are binders to powdered activated carbon here, Perform a granulation by being made from the mixture for granulations which mixed these, put in this granulation article in a metallic mold, and pressing is carried out with a pressing machine with a hot platen, This laminated Plastic solid is calcinated under a nitrogen gas atmosphere after an appropriate time, this is started and obtained to a prescribed dimension, and that size is 92 mm in 0.5 mm [ in thickness ] x 46-mm x length. [ in width ]

[0007] The collector 13 is a conductor in contact with the polarizable electrode 14.

For example, it consists of 10-micrometer-thick aluminium foil, and is a size in which the lead part is 18 mm [ in width ] x 20-80 mm in length and whose collector body part is 46 mm [ in width ] x 92 mm in length.

The separator 15 consists of what has ionic permeability and electric insulation, consists of a porous polypropylene film at 25 micrometers in thickness, for example, and is a size of the same grade as the polarizable electrode 14. Pressure plate P with light-gage \*\*\*\*\* consists of stainless steel, for example, and is a size of the same grade as the polarizable electrode 14.

[0008] Now, an assembly of the electrode layered product 10 by such an industrial robot, The collector 13, the polarizable electrode 14, and several many separators 15 are prepared for each prescribed spot, and it grasps one sheet at a time from each of this stock part, and is carried out by repeating the operation which is carried to a lamination part (pedestal) and is repeated.

[0009] And in order to stick the collector 13 and the polarizable electrode 14 for the obtained electrode layered product 10 in each anode 11 and the negative electrode 12, Electrode layered product 10' which taped on the tape T for bolting, banded together in the state where it pressed to the laminating direction via the aforementioned pressure plate P, and banded together on the tape T is obtained (refer to drawing 5 (b)). While connecting the lead part of the collector 13 of each anode 11 to the positive electrode outside terminal which stores this electrode layered product 10' that banded together in a square-shaped armor case, impregnates the polarizable electrode 14 with a predetermined electrolysis solution, and is fixed to a case top cover by a caulking etc., The lead part of the collector 13 of each negative electrode 12 is connected to a negative-electrode external terminal by a caulking etc., and a case top cover is attached and sealed to the opening of a square-shaped armor case after an appropriate time, for example, the mass electric double layer capacitor of rated voltage 3V and the electric capacity 2000F is assembled.

[0010]

[Problem(s) to be Solved by the Invention] However, since it accumulates the collector 13, the polarizable electrode 14, and three sorts of one simple substance gestalt part of the separator 15 at a time on several multi-sheet (they are about 140 sheets by the total) continuation in order and the electrode layered product 10 is assembled in the conventional electrode layered product 10 mentioned above, When the assembly by an industrial robot was performed, the end of each part article was arranged and laminated from the 1st to last, in order to carry out for not causing a lamination gap, carefully, having had to spend many hours, and time was taken and there was a problem that productivity was bad. Although electrode layered product 10' which banded together on the tape T is stored in an armor case and becomes a product, There was a fear of serious poor quality, such as an electric short circuit between some of anodes and negative electrodes and electrical loss by large increase of the leakage current, being caused by scattering of the activated carbon isolation powder from the polarizable electrode within an armor case, and there was a problem also in respect of reliability.

[0011] The purpose of this invention is as follows.

It was made in order to cancel said conventional problem, and the productivity of an electrode

layered product can be improved.

Provide the electrode layered product for electric double layer capacitors which can improve the reliability of an electric double layer capacitor.

[0012]

[Means for Solving the Problem] In order to attain the aforementioned purpose, an electrode layered product for electric double layer capacitors by invention of claim 1, In an electrode layered product for electric double layer capacitors which makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, In [ said / which was folded up ] a separator of a long sheet shaped folded up by longitudinal direction, It is put into an anode and a negative electrode in the state where it was arranged by turns, and by a heat seal being given to said separator further An anode of the above [ this separator ], One is divided at a time for every negative electrode, and the aforementioned anode and a negative electrode are sealed, respectively, where an electrode lead part is made to project from a separator, and a long accommodation body of this anode of a series of and a negative electrode is turned up to the 1st division fraction [ every ] ZIG ZAG.

[0013] An invention of claim 2 arranges a polarizable electrode in which the aforementioned anode and a negative electrode become the both sides of a collector from activated carbon, respectively in said electrode layered product for electric double layer capacitors according to claim 1.

[0014] In an electrode layered product for electric double layer capacitors which according to the electrode layered product for electric double layer capacitors by this invention makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, Since it is considered as structure which turns up zigzag a long accommodation body sealed so that a series of anodes and a negative electrode might be wrapped in a separator of one long sheet shaped, respectively, in the case of the manufacture. It is not necessary to accumulate one separator of an item gestalt at a time for between [ every ] an anode and a negative electrode. It is not necessary to put in order upwards and to go upwards, until this anode and a negative electrode become a required number about an anode and a "polarizable electrode + collector + polarizable electrode" which constitutes each negative electrode. A polarizable electrode → collector → it is possible to perform operation repeated upwards in order called a polarizable electrode by one of an anode or a negative electrode, and to repeat this. therefore -- differing from the former -- continuation pile number of sheets of simple substance gestalt parts -- only three sheets (a polarizable electrode.) Since there are no worries about a lamination gap by ending with a collector and a polarizable electrode, speedily, and an electrode layered product can be easily obtained by easy folding operation of turning up a thin flat long accommodation body of a series of anodes and a negative electrode to the 1st division fraction [ every ] ZIG ZAG.

[0015] Therefore, compared with an electrode layered product which accumulates a collector, a polarizable electrode, and one each part article of a separator at a time in order upwards, productivity can be improved from the 1st to last over many hours so that the conventional lamination gap may not be caused. Since it seals so that a series of anodes and a negative electrode may be wrapped in a separator of one long sheet shaped, respectively, scattering of activated carbon isolation powder from a polarizable electrode within a stored armor case can be lost, and the reliability of an electric double layer capacitor can be improved.

[0016]

[Embodiment of the Invention] Hereafter, it explains, referring to drawings for an embodiment of the invention. The key map of the assembly line where drawing 1 performs the assembly of the electrode layered product for electric double layer capacitors by this invention, and drawing 2 are the enlarged drawings of the important section of drawing 1. The same numerals are given to said drawing 4 and drawing 5, and identical parts, and explanation is omitted.

[0017] In drawing 1 and drawing 2, separator material 21' is arranged with the gestalt wound around rolled form at the position of the Mogami style, is rewound from a roll, and is continuously sent to the downstream. Separator material 21' consists of a porous polypropylene film, for

example at 25 micrometers in thickness. Two or more guide rollers for 23 to lead separator material 21' from a roll to the downstream (one piece is illustrated in drawing 1), 24 is a longitudinal direction folding mechanism for carrying out the double chip box (it is a double chip box to the move direction and parallel) of separator material 21' which is moving to the downstream through the guide roller 23 to a longitudinal direction so that the width may become half. The numerals A show a lamination zone and the pile mechanism which is not illustrated in this lamination zone A is allocated. In the state where separator material 21' moves a pile mechanism to the lower stream, and a double chip box is being carried out, inside level surface 21' prolonged at a level with this move direction of separator material 21' folded almost right-angled by the folding mechanism 24 -- on a, these three are accumulated in order called the polarizable electrode 14 -> collector 13 -> polarizable electrode 14, and the anode 11 and the negative electrode 12 are formed by turns.

[0018]The numerals B show the seal zone in the downstream of the lamination zone A, and the heat seal machine 25 is allocated in this seal zone B. The place which folded up the heat seal machine 25 with said pile mechanism, and was formed by the mechanism 24, About that with which the anode 11 and the negative electrode 12 were compared in order by turns in [ said / by which the double chip box was carried out ] separator material 21' by which the double chip box was carried out to the longitudinal direction, by giving separator material 21' a heat seal. It is for forming the long accommodation body 22 which seals so that a series of anodes 11 and the negative electrode 12 may be wrapped in the separator 21 with which the heat seal was given, respectively while a double chip box is carried out to a longitudinal direction, and divides this separator 21 in a heat seal part every anode 11 and negative electrode 12. 26 is the zigzag doubling machine allocated in the downstream of the heat seal machine 25, if the long accommodation body 22 sent is turned up to the 1st division fraction [ every ] ZIG ZAG and the anode 11 and the negative electrode 12 become a predetermined number, it will be cut, and it obtains the electrode layered product 20 (refer to drawing 3) for electric double layer capacitors.

[0019]The endless form conveyor which is not illustrated is allocated in the aforementioned lamination zone A and the seal zone B, and a series of anodes 11 and the negative electrode 12 are conveyed [ / separator material 21 ] with the separator 21 after a heat seal by this endless form conveyor to the downstream again. Many concave seat parts with a shallow bottom doubled with the shape dimension of the polarizable electrode 14 and the collector 13 are formed in the surface of this endless form conveyor along the conveyor running direction with the predetermined pitch, According to the position of said concave seat part, the polarizable electrode 14 or the collector 13 is placed on separator material inside level surface 21'a, and, thereby, a lamination gap is prevented. It is controlled so that the conveying operation (carrying pitch) of this endless form conveyor and the pile operation by said pile mechanism synchronize, and said conveying operation and the heat seal operation by the heat seal machine 25 are controlled further to synchronize.

[0020]The roller group 24a for right-angled folding for the above mentioned longitudinal direction folding mechanism 24 to fold up separator material 21' right-angled first in accordance with the move direction (longitudinal direction), The roller 24b for bend line formation for forming a bend line in the center in the cross direction of separator material 21', It is constituted by the plate 24c for right-angled folding for holding the state where it was folded up by the right angle of separator material 21', the plate 24d for finish folding for carrying out the double chip box of separator material 21' folded up right-angled, and the roller group 24e for finish folding.

[0021]The 1st biaxial rectangular-coordinates type robot that the aforementioned pile mechanism which is not illustrated is located in the Mogami style side of the lamination zone A, and places the first polarizable electrode 14 most on separator material inside level surface 21'a, It is located in the downstream of this and constituted by the 2nd biaxial rectangular-coordinates type robot that accumulates the collector 13 on said polarizable electrode 14, and the 3rd biaxial rectangular-coordinates type robot that is located in the downstream of this and accumulates the following polarizable electrode 14 on said collector 13. These biaxial rectangular-coordinates type robots (only henceforth a biaxial robot) are robots which constitute

a biaxial robot arm from two air cylinders, and have many small adsorption pads in the tip part of the piston rod of one air cylinder as a robot hand.

[0022]Next, the assembly procedure of the electrode layered product 20 by this invention is explained, referring to drawing 1 and drawing 2. Separator material 21' from the roll arranged at the Mogami style side is first folded up gradually right-angled by the roller group 24a for right-angled folding, and the roller 24b for bend line formation that a double chip box should be carried out to a longitudinal direction so that the width may become half. Inside level surface 21 of separator material 21' folded up almost right-angled with plate 24c for right-angled folding set up vertically in lamination zone A' -- on a, By said 1st biaxial robot, the first polarizable electrode 14 carries and is placed, Next, by said 2nd biaxial robot, the collector 13 projects that lead part from separator material 21', the bottom is put in the state on this polarizable electrode 14, and the following polarizable electrode 14 is further accumulated on this collector 13 by said 3rd biaxial robot. Such pile operation is repeated and the anode 11 and the negative electrode 12 are formed one after another by turns on inside level surface 21'a which is moving to the downstream.

[0023]And the double chip box of separator material 21' is carried out to a longitudinal direction by the plate 24d for finish folding, and the roller group 24e for finish folding, and it arrives at the seal zone B by them. In the seal zone B, with the heat seal machine 25a for sides first by subsequently a heat seal being given by the heat seal machine 25b for lead parts to that with which the anode 11 and the negative electrode 12 were compared in order by turns in [ by which the double chip box was carried out ] it. While a double chip box is carried out to a longitudinal direction, a series of anodes 11 and the negative electrode 12 are sealed with the separator 21 with which it comes to give a heat seal, respectively, and the long accommodation body 22 divided in a heat seal part is built in this every one separator 21 per the anode 11 and negative electrode 12.

[0024]Thus, the formed thin flat long accommodation body 22 which is prolonged long and slender, It is turned up by the 1st division fraction [ every ] ZIG ZAG with the zigzag doubling machine 26, The lead part of the anode 11 and the lead part of the negative electrode 12 do not become a position which laps mutually by this (refer to drawing 3), It is turned up so that a right-hand side position and the lead part of each negative electrode 12 may become a left-hand side position, if the anode 11 and the negative electrode 12 become a predetermined number (for example, every 20 pieces [ a total of 40 ] each) after an appropriate time, it will be cut, and the lead part of each anode 11 serves as the electrode layered product 20 for electric double layer capacitors as this shows to drawing 3. After this, said pressure plate P is allotted to both outermost part, and it bands together on the tape for bolting in the state where it pressed to the laminating direction (the folding direction) via this pressure plate P.

[0025]Thus, since it is considered as the structure which turns up zigzag the long accommodation body 22 sealed so that a series of anodes 11 and the negative electrode 12 might be wrapped in the separator 21 of one long sheet shaped by which the double chip box was carried out to the longitudinal direction, respectively according to the electrode layered product 20 by this invention, It is not necessary to accumulate one separator of an item gestalt at a time for between [ every ] anode 11 and the negative electrode 12 in the case of the manufacture. the anode 11 and the negative electrode 12 -- it not being necessary to put in order upwards and to go upwards, until this anode 11 and the negative electrode 12 become a required number, and the "polarizable electrode 14+ collector 13+ polarizable electrode 14" which constitutes each. It is possible to perform operation repeated upwards in order called the polarizable electrode 14 -> collector 13 -> polarizable electrode 14 by one of the anode 11 or the negative electrode 12, and to repeat this. Therefore, by the ability of the continuation pile number of sheets of simple substance gestalt parts to be managed with only three sheets (the polarizable electrode 14, the collector 13, and the polarizable electrode 14) unlike the former, since there are no worries about a lamination gap, The electrode layered product 20 can be easily obtained by easy folding operation of speedily and turning up the long accommodation body 22 of a series of anodes 11 and the negative electrode 12 to the 1st division fraction [ every ] ZIG ZAG with a pile mechanism.

[0026]Therefore, compared with the electrode layered product which accumulates a collector, a polarizable electrode, and one each part article of a separator at a time in order upwards, productivity can be improved from the 1st to last over many hours so that the conventional lamination gap may not be caused. Since it seals so that a series of anodes and a negative electrode may be wrapped in the separator of one long sheet shaped, respectively, Since scattering of the activated carbon isolation powder from the polarizable electrode within the stored armor case can be lost and generating with serious poor quality, such as an electric short circuit between some of anodes and negative electrodes and electrical loss by large increase of the leakage current, can be lost, The reliability of an electric double layer capacitor can be improved.

[0027]

[Effect of the Invention]In the electrode layered product which according to the electrode layered product for electric double layer capacitors by this invention makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns as stated above, Since it is considered as the structure which turns up zigzag what was sealed so that a series of anodes and a negative electrode might be wrapped in the separator of one long sheet shaped, respectively, while being able to improve the productivity of an electrode layered product compared with the conventional thing, Scattering of the activated carbon isolation powder from the polarizable electrode which constitutes said anode and negative electrode in the stored armor case can be lost, Since generating with serious poor quality, such as an electric short circuit between some of anodes and negative electrodes and large increase of the leakage current, can be lost, the reliability of an electric double layer capacitor can be improved.

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**TECHNICAL FIELD**

[Field of the Invention]This invention about the electrode layered product which is the main components of an electric double layer capacitor, makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, it is an electrode layered product which laminates many anodes and negative electrodes by turns especially -- 100 electric capacity -- several -- the mass electric double layer capacitor (electric double layer capacitor for power) of 1000F -- it is related with the electrode layered product for electric double layer capacitors suitable as business.

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## PRIOR ART

[Description of the Prior Art]As everyone knows, the electrical energy by the electric charge accumulated in the electric double layer formed in the interface of a polarizable electrode and an electrolysis solution is used for an electric double layer capacitor. In recent years, development of what is called a mass electric double layer capacitor (electric double layer capacitor for power) of low resistance is furthered with the large scale which is hundreds in which the large current discharging more than an ampere order is possible – the number 1000F, and application for power uses, such as a power supply for motor drives, is advanced. What impregnated this with the electrolysis solution and stored the electrode layered product which makes a separator intervene among them and accumulates two or more anodes and two or more negative electrodes by turns as one of such the mass electric double layer capacitors in the square-shaped armor case is known.

[0003]Drawing 4 is a figure for explaining the composition of the electrode layered product for the conventional mass electric double layer capacitors.

[0004]An assembly of the conventional electrode layered product uses an industrial robot (graphic display abbreviation) with the robot hand to which many small adsorption pads were attached, and are the following (A). – (F) It was carried out in the procedure. That is, pressure plate [ of one sheet ] P which makes a rectangle is laid on the pedestal which is not illustrated, and it is (A). The separator 15 of one sheet which makes the shape of a rectangular sheet next is layered. (B) Rank second, layer the polarizable electrode 14 of the rectangle thin plate state of one sheet, the collector 13 of one sheet of the shape of a rectangular sheet which has an narrow band-like lead part for external terminal connection, and the polarizable electrode 14 of one sheet as follows on this order, and form the one negative electrode 12. (C) Layer the separator 15 of one sheet on the polarizable electrode 14 of said negative-electrode 12 upper part. (D) Then, layer the polarizable electrode 14 of one sheet, the collector 13 of one sheet of the shape of a rectangular sheet which has an narrow band-like lead part, and the polarizable electrode 14 of one sheet as follows on this order, and form the one anode 11. About the collector 13, as it is indicated in drawing 4 and drawing 5 as the thing for anodes, and the thing for negative electrodes, it laminates so that the lead part for anodes and the lead part for negative electrodes may not lap and it may become a position of right-and-left reverse.

[0005](E) Rank second and it is the above (A). – (D) The number of necessary times repeats a procedure. For example, it laminates at a time by turns [ 20 ] the negative electrode 12 and the anode 11 via the separator 15. (F) And layer the separator 15 of one sheet on the polarizable electrode 14 of the anode 11 upper part arranged on the outermost part. Such is carried out, the electrode layered product 50 (refer to drawing 5 (a)) which makes the separator 15 intervene among them and laminates the anode 11 and the negative electrode 12 of a required number by turns is assembled, finally pressure plate [ of one sheet ] P is layered, and an assembly is ended.

[0006]Said polarizable electrode 14 adds first granular phenol resin and the solvent for phenol resin distribution which are binders to powdered activated carbon here, Perform a granulation by being made from the mixture for granulations which mixed these, put in this granulation article in a metallic mold, and pressing is carried out with a pressing machine with a hot platen, This

laminated Plastic solid is calcinated under a nitrogen gas atmosphere after an appropriate time, this is started and obtained to a prescribed dimension, and that size is 92 mm in 0.5 mm[ in thickness ] x46-mm x length. [ in width ]

[0007]The collector 13 is a conductor in contact with the polarizable electrode 14.

For example, it consists of 10-micrometer-thick aluminium foil, and is a size in which the lead part is 18 mm[ in width ] x20-80 mm in length and whose collector body part is 46 mm[ in width ] x92 mm in length.

The separator 15 consists of what has ionic permeability and electric insulation, consists of a porous polypropylene film at 25 micrometers in thickness, for example, and is a size of the same grade as the polarizable electrode 14. Pressure plate P with light-gage \*\*\*\*\* consists of stainless steel, for example, and is a size of the same grade as the polarizable electrode 14.

[0008]Now, an assembly of the electrode layered product 10 by such an industrial robot, The collector 13, the polarizable electrode 14, and several many separators 15 are prepared for each prescribed spot, and it grasps one sheet at a time from each of this stock part, and is carried out by repeating the operation which is carried to a lamination part (pedestal) and is repeated.

[0009]And in order to stick the collector 13 and the polarizable electrode 14 for the obtained electrode layered product 10 in each anode 11 and the negative electrode 12, Electrode layered product 10' which taped on the tape T for bolting, banded together in the state where it pressed to the laminating direction via the aforementioned pressure plate P, and banded together on the tape T is obtained (refer to drawing 5 (b)). While connecting the lead part of the collector 13 of each anode 11 to the positive electrode outside terminal which stores this electrode layered product 10' that banded together in a square-shaped armor case, impregnates the polarizable electrode 14 with a predetermined electrolysis solution, and is fixed to a case top cover by a caulking etc., The lead part of the collector 13 of each negative electrode 12 is connected to a negative-electrode external terminal by a caulking etc., and a case top cover is attached and sealed to the opening of a square-shaped armor case after an appropriate time, for example, the mass electric double layer capacitor of rated voltage 3V and the electric capacity 2000F is assembled.

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**EFFECT OF THE INVENTION**

[Effect of the Invention]In the electrode layered product which according to the electrode layered product for electric double layer capacitors by this invention makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns as stated above, Since it is considered as the structure which turns up zigzag what was sealed so that a series of anodes and a negative electrode might be wrapped in the separator of one long sheet shaped, respectively, while being able to improve the productivity of an electrode layered product compared with the conventional thing, Scattering of the activated carbon isolation powder from the polarizable electrode which constitutes said anode and negative electrode in the stored armor case can be lost, Since generating with serious poor quality, such as an electric short circuit between some of anodes and negative electrodes and large increase of the leakage current, can be lost, the reliability of an electric double layer capacitor can be improved.

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**TECHNICAL PROBLEM**

[Problem(s) to be Solved by the Invention]However, since it accumulates the collector 13, the polarizable electrode 14, and three sorts of one simple substance gestalt part of the separator 15 at a time on several multi-sheet (they are about 140 sheets by the total) continuation in order and the electrode layered product 10 is assembled in the conventional electrode layered product 10 mentioned above, When the assembly by an industrial robot was performed, the end of each part article was arranged and laminated from the 1st to last, in order to carry out for not causing a lamination gap, carefully, having had to spend many hours, and time was taken and there was a problem that productivity was bad. Although electrode layered product 10' which banded together on the tape T is stored in an armor case and becomes a product, There was a fear of serious poor quality, such as an electric short circuit between some of anodes and negative electrodes and electrical loss by large increase of the leakage current, being caused by scattering of the activated carbon isolation powder from the polarizable electrode within an armor case, and there was a problem also in respect of reliability.

[0011]The purpose of this invention is as follows.

It was made in order to cancel said conventional problem, and the productivity of an electrode layered product can be improved.

Provide the electrode layered product for electric double layer capacitors which can improve the reliability of an electric double layer capacitor.

[Translation done.]

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## MEANS

[Means for Solving the Problem]In order to attain the aforementioned purpose, an electrode layered product for electric double layer capacitors by invention of claim 1, In an electrode layered product for electric double layer capacitors which makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, In [ said / which was folded up ] a separator of a long sheet shaped folded up by longitudinal direction, It is put into an anode and a negative electrode in the state where it was arranged by turns, and by a heat seal being given to said separator further An anode of the above [ this separator ], One is divided at a time for every negative electrode, and the aforementioned anode and a negative electrode are sealed, respectively, where an electrode lead part is made to project from a separator, and a long accommodation body of this anode of a series of and a negative electrode is turned up to the 1st division fraction [ every ] ZIG ZAG.

[0013]An invention of claim 2 arranges a polarizable electrode in which the aforementioned anode and a negative electrode become the both sides of a collector from activated carbon, respectively in said electrode layered product for electric double layer capacitors according to claim 1.

[0014]In an electrode layered product for electric double layer capacitors which according to the electrode layered product for electric double layer capacitors by this invention makes a separator intervene among them and laminates two or more anodes and two or more negative electrodes by turns, Since it is considered as structure which turns up zigzag a long accommodation body sealed so that a series of anodes and a negative electrode might be wrapped in a separator of one long sheet shaped, respectively, in the case of the manufacture. It is not necessary to accumulate one separator of an item gestalt at a time for between [ every ] an anode and a negative electrode. It is not necessary to put in order upwards and to go upwards, until this anode and a negative electrode become a required number about an anode and a "polarizable electrode + collector + polarizable electrode" which constitutes each negative electrode. A polarizable electrode → collector → it is possible to perform operation repeated upwards in order called a polarizable electrode by one of an anode or a negative electrode, and to repeat this. therefore -- differing from the former -- continuation pile number of sheets of simple substance gestalt parts -- only three sheets (a polarizable electrode.) Since there are no worries about a lamination gap by ending with a collector and a polarizable electrode, speedily, and an electrode layered product can be easily obtained by easy folding operation of turning up a thin flat long accommodation body of a series of anodes and a negative electrode to the 1st division fraction [ every ] ZIG ZAG.

[0015]Therefore, compared with an electrode layered product which accumulates a collector, a polarizable electrode, and one each part article of a separator at a time in order upwards, productivity can be improved from the 1st to last over many hours so that the conventional lamination gap may not be caused. Since it seals so that a series of anodes and a negative electrode may be wrapped in a separator of one long sheet shaped, respectively, scattering of activated carbon isolation powder from a polarizable electrode within a stored armor case can be lost, and the reliability of an electric double layer capacitor can be improved.

[0016]

[Embodiment of the Invention] Hereafter, it explains, referring to drawings for an embodiment of the invention. The key map of the assembly line where drawing 1 performs the assembly of the electrode layered product for electric double layer capacitors by this invention, and drawing 2 are the enlarged drawings of the important section of drawing 1. The same numerals are given to said drawing 4 and drawing 5, and identical parts, and explanation is omitted.

[0017] In drawing 1 and drawing 2, separator material 21' is arranged with the gestalt wound around rolled form at the position of the Mogami style, is rewound from a roll, and is continuously sent to the downstream. Separator material 21' consists of a porous polypropylene film, for example at 25 micrometers in thickness. Two or more guide rollers for 23 to lead separator material 21' from a roll to the downstream (one piece is illustrated in drawing 1), 24 is a longitudinal direction folding mechanism for carrying out the double chip box (it is a double chip box to the move direction and parallel) of separator material 21' which is moving to the downstream through the guide roller 23 to a longitudinal direction so that the width may become half. The numerals A show a lamination zone and the pile mechanism which is not illustrated in this lamination zone A is allocated. In the state where separator material 21' moves a pile mechanism to the lower stream, and a double chip box is being carried out, inside level surface 21' prolonged at a level with this move direction of separator material 21' folded almost right-angled by the folding mechanism 24 -- on a, these three are accumulated in order called the polarizable electrode 14 -> collector 13 -> polarizable electrode 14, and the anode 11 and the negative electrode 12 are formed by turns.

[0018] The numerals B show the seal zone in the downstream of the lamination zone A, and the heat seal machine 25 is allocated in this seal zone B. The place which folded up the heat seal machine 25 with said pile mechanism, and was formed by the mechanism 24, About that with which the anode 11 and the negative electrode 12 were compared in order by turns in [ said / by which the double chip box was carried out ] separator material 21' by which the double chip box was carried out to the longitudinal direction, by giving separator material 21' a heat seal. It is for forming the long accommodation body 22 which seals so that a series of anodes 11 and the negative electrode 12 may be wrapped in the separator 21 with which the heat seal was given, respectively while a double chip box is carried out to a longitudinal direction, and divides this separator 21 in a heat seal part every anode 11 and negative electrode 12. 26 is the zigzag doubling machine allocated in the downstream of the heat seal machine 25, if the long accommodation body 22 sent is turned up to the 1st division fraction [ every ] ZIG ZAG and the anode 11 and the negative electrode 12 become a predetermined number, it will be cut, and it obtains the electrode layered product 20 (refer to drawing 3) for electric double layer capacitors.

[0019] The endless form conveyor which is not illustrated is allocated in the aforementioned lamination zone A and the seal zone B, and a series of anodes 11 and the negative electrode 12 are conveyed [ / separator material 21 ] with the separator 21 after a heat seal by this endless form conveyor to the downstream again. Many concave seat parts with a shallow bottom doubled with the shape dimension of the polarizable electrode 14 and the collector 13 are formed in the surface of this endless form conveyor along the conveyor running direction with the predetermined pitch, According to the position of said concave seat part, the polarizable electrode 14 or the collector 13 is placed on separator material inside level surface 21'a, and, thereby, a lamination gap is prevented. It is controlled so that the conveying operation (carrying pitch) of this endless form conveyor and the pile operation by said pile mechanism synchronize, and said conveying operation and the heat seal operation by the heat seal machine 25 are controlled further to synchronize.

[0020] The roller group 24a for right-angled folding for the above mentioned longitudinal direction folding mechanism 24 to fold up separator material 21' right-angled first in accordance with the move direction (longitudinal direction), The roller 24b for bend line formation for forming a bend line in the center in the cross direction of separator material 21', It is constituted by the plate 24c for right-angled folding for holding the state where it was folded up by the right angle of separator material 21', the plate 24d for finish folding for carrying out the double chip box of separator material 21' folded up right-angled, and the roller group 24e for finish folding.

[0021]The 1st biaxial rectangular-coordinates type robot that the aforementioned pile mechanism which is not illustrated is located in the Mogami style side of the lamination zone A, and places the first polarizable electrode 14 most on separator material inside level surface 21'a, It is located in the downstream of this and constituted by the 2nd biaxial rectangular-coordinates type robot that accumulates the collector 13 on said polarizable electrode 14, and the 3rd biaxial rectangular-coordinates type robot that is located in the downstream of this and accumulates the following polarizable electrode 14 on said collector 13. These biaxial rectangular-coordinates type robots (only henceforth a biaxial robot) are robots which constitute a biaxial robot arm from two air cylinders, and have many small adsorption pads in the tip part of the piston rod of one air cylinder as a robot hand.

[0022]Next, the assembly procedure of the electrode layered product 20 by this invention is explained, referring to drawing 1 and drawing 2. Separator material 21' from the roll arranged at the Mogami style side is first folded up gradually right-angled by the roller group 24a for right-angled folding, and the roller 24b for bend line formation that a double chip box should be carried out to a longitudinal direction so that the width may become half. inside level surface 21 of separator material 21' folded up almost right-angled with plate 24c for right-angled folding set up vertically in lamination zone A' -- on a, By said 1st biaxial robot, the first polarizable electrode 14 carries and is placed, Next, by said 2nd biaxial robot, the collector 13 projects that lead part from separator material 21', the bottom is put in the state on this polarizable electrode 14, and the following polarizable electrode 14 is further accumulated on this collector 13 by said 3rd biaxial robot. Such pile operation is repeated and the anode 11 and the negative electrode 12 are formed one after another by turns on inside level surface 21'a which is moving to the downstream.

[0023]And the double chip box of separator material 21' is carried out to a longitudinal direction by the plate 24d for finish folding, and the roller group 24e for finish folding, and it arrives at the seal zone B by them. In the seal zone B, with the heat seal machine 25a for sides first by subsequently a heat seal being given by the heat seal machine 25b for lead parts to that with which the anode 11 and the negative electrode 12 were compared in order by turns in [ by which the double chip box was carried out ] it. While a double chip box is carried out to a longitudinal direction, a series of anodes 11 and the negative electrode 12 are sealed with the separator 21 with which it comes to give a heat seal, respectively, and the long accommodation body 22 divided in a heat seal part is built in this every one separator 21 per the anode 11 and negative electrode 12.

[0024]Thus, the formed thin flat long accommodation body 22 which is prolonged long and slender, It is turned up by the 1st division fraction [ every ] ZIG ZAG with the zigzag doubling machine 26, The lead part of the anode 11 and the lead part of the negative electrode 12 do not become a position which laps mutually by this (refer to drawing 3), It is turned up so that a right-hand side position and the lead part of each negative electrode 12 may become a left-hand side position, if the anode 11 and the negative electrode 12 become a predetermined number (for example, every 20 pieces [ a total of 40 ] each) after an appropriate time, it will be cut, and the lead part of each anode 11 serves as the electrode layered product 20 for electric double layer capacitors as this shows to drawing 3. After this, said pressure plate P is allotted to both outermost part, and it bands together on the tape for bolting in the state where it pressed to the laminating direction (the folding direction) via this pressure plate P.

[0025]Thus, since it is considered as the structure which turns up zigzag the long accommodation body 22 sealed so that a series of anodes 11 and the negative electrode 12 might be wrapped in the separator 21 of one long sheet shaped by which the double chip box was carried out to the longitudinal direction, respectively according to the electrode layered product 20 by this invention, It is not necessary to accumulate one separator of an item gestalt at a time for between [ every ] anode 11 and the negative electrode 12 in the case of the manufacture. the anode 11 and the negative electrode 12 -- it not being necessary to put in order upwards and to go upwards, until this anode 11 and the negative electrode 12 become a required number, and the "polarizable electrode 14+ collector 13+ polarizable electrode 14" which constitutes each. It is possible to perform operation repeated upwards in order called the



polarizable electrode 14 → collector 13 → polarizable electrode 14 by one of the anode 11 or the negative electrode 12, and to repeat this. Therefore, by the ability of the continuation pile number of sheets of simple substance gestalt parts to be managed with only three sheets (the polarizable electrode 14, the collector 13, and the polarizable electrode 14) unlike the former, since there are no worries about a lamination gap, The electrode layered product 20 can be easily obtained by easy folding operation of speedily and turning up the long accommodation body 22 of a series of anodes 11 and the negative electrode 12 to the 1st division fraction [ every ] ZIG ZAG with a pile mechanism.

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## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a key map of the assembly line which performs the assembly of the electrode layered product for electric double layer capacitors by this invention.

[Drawing 2]It is an enlarged drawing of the important section of drawing 1.

[Drawing 3]It is a perspective view showing the electrode layered product for electric double layer capacitors by this invention.

[Drawing 4]It is a figure for explaining the composition of the electrode layered product for the conventional mass electric double layer capacitors.

[Drawing 5]It is a perspective view showing the conventional electrode layered product for electric double layer capacitors, and this electrode layered product that banded together on the tape.

[Description of Notations]

11 -- Anode 12 -- Negative electrode 13 -- Collector 14 -- Polarizable electrode 20 -- Electrode layered product for electric double layer capacitors 21 -- Separator 21' -- Separator material

21'a -- The inside level surface of a separator material 22 -- Long accommodation body 23 -- Guide roller

24 -- Longitudinal direction folding mechanism 24a -- Roller group for right-angled folding 24b -- Roller for bend line formation 21c -- Plate for right-angled folding 24d -- Plate for finish folding

24e -- Roller group for finish folding 25 -- Heat seal machine 25a -- Heat seal machine for sides 25b -- Heat seal machine for lead parts 26 -- Zigzag doubling machine A -- Lamination zone

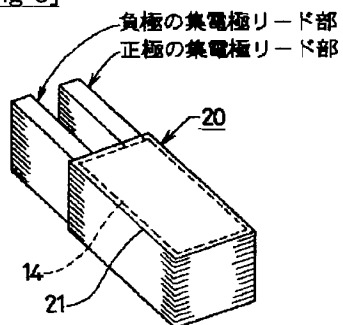
B -- Seal zone

[Translation done.]

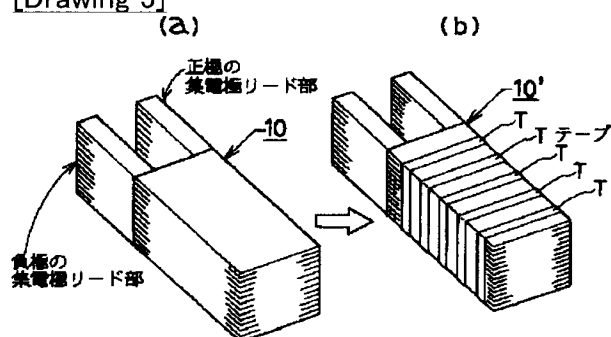
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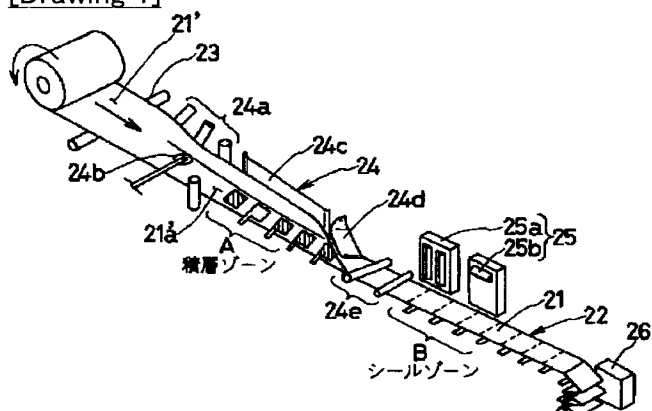
[Drawing 3]



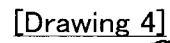
[Drawing 5]



[Drawing 1]



[Drawing 2]



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(54)【発明の名称】 電気二重層コンデンサ用電極積層体

(57)【要約】

【課題】 電極積層体の生産性を向上できるとともに、電気二重層コンデンサの信頼性を高めることができるようにすること。

【解決手段】 複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積層してなる電気二重層コンデンサ用電極積層体において、長手方向に折り畳まれた長尺シート状のセパレータの前記折り畳まれた中に、正極と負極とが交互に順に並べられた状態で入れられており、さらに、前記セパレータに熱シールが施されることで該セパレータは前記正極、負極ごとに一つずつ区画され、かつ前記正極、負極は電極リード部をセパレータから突出させた状態でそれぞれ密閉されており、この一連の正極、負極の長尺収納体を1区画分ずつジグザグに折り重ねてなる電気二重層コンデンサ用電極積層体。

**【特許請求の範囲】**

【請求項1】 複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積層してなる電気二重層コンデンサ用電極積層体において、

長手方向に折り畳まれた長尺シート状のセパレータの前記折り畳まれた中に、正極と負極とが交互に並べられた状態で入れられており、さらに、前記セパレータに熱シールが施されることで該セパレータは前記の正極、負極ごとに一つずつ区画され、かつ前記の正極、負極は電極リード部をセパレータから突出させた状態でそれぞれ密閉されており、この一連の正極、負極の長尺収納体を1区画分ずつジグザグに折り重ねてなることを特徴とする電気二重層コンデンサ用電極積層体。

【請求項2】 前記の正極、負極が、それぞれ、集電極の両側に活性炭よりなる分極性電極を配したものであることを特徴とする請求項1記載の電気二重層コンデンサ用電極積層体。

**【発明の詳細な説明】****【0001】**

【発明の属する技術分野】本発明は、電気二重層コンデンサの主構成要素であって複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積層してなる電極積層体に関し、特に、正極と負極とを多数個交互に積層してなる電極積層体であって静電容量数百～数千Fの大容量電気二重層コンデンサ（パワー用電気二重層コンデンサ）用として好適な、電気二重層コンデンサ用電極積層体に関するものである。

**【0002】**

【従来の技術】周知のように、電気二重層コンデンサは、分極性電極と電解液との界面に形成される電気二重層に蓄積される電荷による電気エネルギーを利用するものである。近年、アンペアオーダー以上の大電流放電が可能数百～数千Fの大容量で低抵抗のいわゆる大容量電気二重層コンデンサ（パワー用電気二重層コンデンサ）の開発が進められており、モータ駆動用の電源などのパワー用途への適用が進められている。このような大容量電気二重層コンデンサの一つとして、複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積み重ねてなる電極積層体を、これに電解液を含浸させて角形の外装ケース内に収納したものが知られている。

【0003】図4は従来の大容量電気二重層コンデンサ用の電極積層体の構成を説明するための図である。

【0004】従来の電極積層体の組立ては、多数個の小形吸着パッドが取り付けられたロボットハンドを持つ産業用ロボット（図示省略）を用い、以下の(A)～(F)の手順で行われていた。すなわち、図示しない基台上に矩形をなす1枚の押え板Pを載置しておき、(A)次に矩形シート状をなす1枚のセパレータ15を重ね置く。(B)次いで、1枚の矩形薄板状の分極性電極14、外部端子

接続用の狭幅帯状のリード部を有する矩形シート状の1枚の集電極13、及び次の1枚の分極性電極14をこの順に重ね置いて、1つの負極12を形成する。(C)前記負極12の上側の分極性電極14上に1枚のセパレータ15を重ね置く。(D)続いて、1枚の分極性電極14、狭幅帯状のリード部を有する矩形シート状の1枚の集電極13、及び次の1枚の分極性電極14をこの順に重ね置いて、1つの正極11を形成する。なお、集電極13については、正極用のものと負極用のものとは、図4及び図5に示すように、正極用のリード部と負極用のリード部とが重ならないよう左右逆の位置になるように積層される。

【0005】(E)次いで、前記(A)～(D)の手順を所要回数繰り返す。例えば、負極12と正極11とをセパレータ15を介して交互に20個ずつ積層する。(F)そして、最外部に配される正極11の上側の分極性電極14上に1枚のセパレータ15を重ね置く。このようにして所要数の正極11と負極12とをそれらの間にセパレータ15を介在させて交互に積層してなる電極積層体50

(図5(a)参照)が組み立てられ、最後に1枚の押え板Pを重ね置いて組立てを終了する。

【0006】ここで、前記分極性電極14は、まず、粉末活性炭に結着剤である粒状フェノール樹脂とフェノール樹脂分散用溶剤とを加え、これらを混合した造粒用混合物を材料として造粒を行い、該造粒品を金型内に入れて熱板付きプレス機にて加圧成形し、しかる後この薄板状成形体を窒素ガス雰囲気下にて焼成し、これを所定寸法に切り出して得たものであり、その寸法が例えば、厚み0.5mm×幅46mm×長さ92mmのものである。

【0007】また、集電極13は、分極性電極14に接触する導電体であり、例えば、厚み10 $\mu$ mのアルミニウム箔よりなるもので、そのリード部が幅18mm×長さ20～80mm、集電極本体部が幅46mm×長さ92mmの大きさである。セパレータ15は、イオン透過性及び電気絶縁性を有するものからなり、例えば、厚み25 $\mu$ mで多孔質のポリプロピレンフィルムよりなり、分極性電極14と同じ程度の大きさである。薄肉で剛性を持つ押え板Pは、例えばステンレス鋼よりなり、分極性電極14と同じ程度の大きさである。

【0008】さて、このような産業用ロボットによる電極積層体10の組立ては、集電極13、分極性電極14及びセパレータ15を、それぞれの所定箇所にも多数枚用意しておき、この各ストック箇所から1枚ずつ把持して積層箇所（基台）へ運び積み重ねる動作を繰り返すことにより行われている。

【0009】そして、得られた電極積層体10を、各正極11、負極12において集電極13と分極性電極14とを密着させるために、前記の押え板Pを介して積層方向に押圧した状態で締付け用テープTによりテーピング

して結束し、テープ T で結束した電極積層体 1 0' を得る(図 5 (b) 参照)。この結束した電極積層体 1 0' を角形外装ケース内に収納し分極性電極 1 4 に所定の電解液を含浸させ、ケース上蓋に固定される正極外部端子に各正極 1 1 の集電極 1 3 のリード部をかしめ等によって接続するとともに、負極外部端子に各負極 1 2 の集電極 1 3 のリード部をかしめ等によって接続し、しかる後、角形の外装ケースの開口部にケース上蓋を取り付けて密閉し、例えば、定格電圧 3 V・静電容量 2 0 0 0 F の大容量の電気二重層コンデンサが組立てられている。

#### 【0 0 1 0】

【発明が解決しようとする課題】しかし前述した従来の電極積層体 1 0 では、集電極 1 3、分極性電極 1 4 及びセパレータ 1 5 の 3 種の単体形態部品を 1 枚ずつ順に多数枚(例えば総計で約 1 4 0 枚程度)連続に積み重ねて電極積層体 1 0 を組み立てるようにしたものであるから、産業用ロボットによる組立てを行う場合、第 1 番目から最終まで各部品の端をそろえて積層し、積層ずれを起こさないするために時間をかけて慎重に積み重ねを行わねばならず、時間がかかって生産性が悪いという問題があった。また、テープ T で結束された電極積層体 1 0' は外装ケース内に収納されて製品となるが、外装ケース内での分極性電極からの活性炭遊離粉の飛散により、一部の正極・負極間での電氣的短絡や、漏れ電流の大幅増大による電氣的損失などの重大な品質不良が引き起こされる心配があり、信頼性の点でも問題があった。

【0 0 1 1】本発明は、前記従来の問題点を解消するためになされたもので、電極積層体の生産性を向上できるとともに、電気二重層コンデンサの信頼性を高めることができる電気二重層コンデンサ用電極積層体を提供することを目的とする。

#### 【0 0 1 2】

【課題を解決するための手段】前記の目的を達成するために、請求項 1 の発明による電気二重層コンデンサ用電極積層体は、複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積層してなる電気二重層コンデンサ用電極積層体において、長手方向に折り畳まれた長尺シート状のセパレータの前記折り畳まれた中に、正極と負極とが交互に並べられた状態で入れられており、さらに、前記セパレータに熱シールが施されることで該セパレータは前記の正極、負極ごとに一つずつ区画され、かつ前記の正極、負極は電極リード部をセパレータから突出させた状態でそれぞれ密閉されており、この一連の正極、負極の長尺収納体を 1 区画分ずつジグザグに折り重ねてなることを特徴とするものである。

【0 0 1 3】請求項 2 の発明は、前記請求項 1 記載の電気二重層コンデンサ用電極積層体において、前記の正極、負極が、それぞれ、集電極の両側に活性炭よりなる分極性電極を配したものであることを特徴とするものである。

【0 0 1 4】本発明による電気二重層コンデンサ用電極積層体によると、複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積層してなる電気二重層コンデンサ用電極積層体において、一つの長尺シート状のセパレータで一連の正極、負極をそれぞれ包むように密閉した長尺収納体をジグザグに折り重ねてなる構造としたものであるから、その製作の際には、各正極・負極間ごとに単品形態のセパレータを 1 枚ずつ積み重ねる必要がなく、また、正極、負極それぞれを構成する「分極性電極+集電極+分極性電極」を該正極及び負極が所要数になるまで上へ上へと順に積み重ねて行く必要がなく、分極性電極→集電極→分極性電極という順で上へと積み重ねる操作は正極あるいは負極の 1 つ分だけ行い、これを繰り返すことでよい。したがって従来と違って、単体形態部品の連続積み重ね枚数がわずかに 3 枚(分極性電極、集電極及び分極性電極)で済むことで積層ずれの心配がないのでスピーディに積み重ねを行え、また、一連の正極、負極の薄く平たい長尺収納体を 1 区画分ずつジグザグに折り重ねるといった簡単な折り重ね操作で容易に電極積層体を得ることができる。

【0 0 1 5】よって、従来の、積層ずれを起こさないように時間をかけて第 1 番目から最終まで、集電極、分極性電極及びセパレータの各部品を 1 枚ずつ上へ上へと順に積み重ねてなる電極積層体に比べて、生産性を向上できる。さらに、一つの長尺シート状のセパレータで一連の正極、負極をそれぞれ包むように密閉したものであるから、収納された外装ケース内での分極性電極からの活性炭遊離粉の飛散をなくすることができ、電気二重層コンデンサの信頼性を高めることができる。

#### 【0 0 1 6】

【発明の実施の形態】以下、本発明の実施の形態について図面を参照しながら説明する。図 1 は本発明による電気二重層コンデンサ用電極積層体の組立を行う組立ラインの概念図、図 2 は図 1 の要部の拡大図である。なお、前記図 4 及び図 5 と同一部分には同一の符号を付して説明を省略する。

【0 0 1 7】図 1 及び図 2 において、セパレータ材 2 1' はロール状に巻かれた形態で最上流の位置に配置され、ロールから巻き戻されて下流側へ連続的に送られるようになっている。セパレータ材 2 1' は、例えば厚み 2 5  $\mu\text{m}$  で多孔質のポリプロピレンフィルムよりなるものである。2 3 はロールからのセパレータ材 2 1' を下流側へ導くための複数の案内ローラ(図 1 では 1 個のみ図示)、2 4 は案内ローラ 2 3 を経て下流側へ移動しているセパレータ材 2 1' をその幅が半分になるように長手方向に二重折り(移動方向と平行に二重折り)するための長手方向折畳み機構である。符号 A は積層ゾーンを示し、この積層ゾーン A に図示しない積重ね機構が配設されている。積重ね機構は、セパレータ材 2 1' が下流へ移動し、かつ二重折りされつつある状態において、折

畳み機構24によってほぼ直角に折られたセパレータ材21'の該移動方向に水平に延びる内側水平面21'a上に、分極性電極14→集電極13→分極性電極14という順でこの3つを積み重ねて、正極11と負極12とを交互に形成するものである。

【0018】符号Bは積層ゾーンAの下流側にあるシールゾーンを示し、このシールゾーンBに熱シール機25が配設されている。熱シール機25は、前記積み重ね機構と折り畳み機構24とにより形成されたところの、長手方向に二重折りされたセパレータ材21'の前記二重折りされた中に正極11と負極12とが交互に順に並べられたものについて、セパレータ材21'に熱シールを施すことで、長手方向に二重折りされるとともに熱シールが施されたセパレータ21で一連の正極11、負極12をそれぞれ包むように密閉し、かつ、該セパレータ21を正極11、負極12ごとに熱シール部で区画してなる長尺収納体22を形成するためのものである。26は熱シール機25の下流側に配設されたジグザグ折重ね機であり、送られてくる長尺収納体22を1区画分ずつジグザグに折り重ね、正極11及び負極12が所定数になると切断し、電気二重層コンデンサ用電極積層体20（図3参照）を得るようにしたものである。

【0019】なお、前記の積層ゾーンA及びシールゾーンBには図示しない無端状コンベアが配設されており、この無端状コンベアにより、一連の正極11、負極12は、セパレータ材21'とともに、また、熱シール後にはセパレータ21とともに下流側へ搬送されるようになっている。この無端状コンベアの表面には、分極性電極14及び集電極13の形状寸法に合わせた底の浅い凹状収容部が所定ピッチでコンベア走行方向に沿って多数形成されており、前記凹状収容部の位置に合わせてセパレータ材内側水平面21'a上に分極性電極14あるいは集電極13が置かれ、これにより積層ずれが防止されるようになっている。また、この無端状コンベアの搬送動作（搬送ピッチ）と前記積み重ね機構による積み重ね動作とは同期するように制御されており、さらに、前記搬送動作と熱シール機25による熱シール動作とは同期するように制御されている。

【0020】前記した長手方向折り畳み機構24は、セパレータ材21'を移動方向（長手方向）に沿ってまず直角に折り畳むための直角折り畳み用ローラ群24aと、セパレータ材21'の幅方向における中央に折り線を形成するための折り線形成用ローラ24bと、セパレータ材21'の直角に折り畳まれた状態を保持するための直角折り畳み用プレート24cと、直角に折り畳まれたセパレータ材21'を二重折りするための仕上折り畳み用プレート24d及び仕上折り畳み用ローラ群24eとにより構成されている。

【0021】また、前記の図示しない積み重ね機構は、積層ゾーンAの最上流側に位置し、セパレータ材内側水平

面21'a上に一番はじめの分極性電極14を置く第1の2軸直交座標形ロボットと、これの下流側に位置し、前記分極性電極14上に集電極13を積み重ねる第2の2軸直交座標形ロボットと、これの下流側に位置し、前記集電極13上に次の分極性電極14を積み重ねる第3の2軸直交座標形ロボットとにより構成されている。これらの2軸直交座標形ロボット（以下、単に2軸ロボットという）は、2つのエアシリンダで2軸のロボットアームを構成し、一方のエアシリンダのピストンロッドの先端部にロボットハンドとして多数個の小形吸着パッドを持つロボットである。

【0022】次に、図1及び図2を参照しながら、本発明による電極積層体20の組立て手順を説明する。最上流側に配置されたロールからのセパレータ材21'は、その幅が半分になるように長手方向に二重折りすべく、まず、直角折り畳み用ローラ群24a及び折り線形成用ローラ24bにより徐々に直角に折り畳まれる。積層ゾーンAにおいて、垂直に立設された直角折り畳み用プレート24cによってほぼ直角に折り畳まれたセパレータ材21'の内側水平面21'a上に、前記第1の2軸ロボットによってはじめの分極性電極14が載せ置かれ、次に、前記第2の2軸ロボットによってこの分極性電極14上に集電極13がそのリード部をセパレータ材21'より突き出した状態で積み重ねられ、さらに、前記第3の2軸ロボットによってこの集電極13上に次の分極性電極14が積み重ねられる。このような積み重ね動作が繰り返されて、下流側へ移動している内側水平面21'a上に、正極11と負極12とが交互に次々と形成される。

【0023】そして、仕上折り畳み用プレート24d及び仕上折り畳み用ローラ群24eとによってセパレータ材21'は長手方向に二重折りされ、シールゾーンBに達する。シールゾーンBにおいて、その二重折りされた中に正極11と負極12とが交互に順に並べられたものに、まずサイド用熱シール機25aにより、次いでリード部用熱シール機25bにより熱シールが施されることで、長手方向に二重折りされるとともに熱シールが施されるセパレータ21で一連の正極11、負極12をそれぞれ密閉し、かつ、該セパレータ21を正極11、負極12ごとに一つずつ熱シール部で区画してなる長尺収納体22がつけられる。

【0024】このようにして形成された細長く延びる薄く平たい長尺収納体22は、ジグザグ折重ね機26により1区画分ずつジグザグに折り重ねられ、これにより正極11のリード部と負極12のリード部とが互いに重なる位置になることがなく（図3参照）、各正極11のリード部が例えば右側位置、各負極12のリード部が左側位置になるように折り重ねられ、しかる後、正極11及び負極12が所定数（例えば各20個ずつ合計40個）になると切断され、これが図3に示すような電気二重層

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コンデンサ用電極積層体 20 となる。なお、この後、両方の最外部に前記押え板 P が配され、この押え板 P を介して積層方向（折り重ね方向）に押圧した状態で締付け用テープにより結束されるようになっている。

【0025】このように、本発明による電極積層体 20 によると、長手方向に二重折りされた一つの長尺シート状のセパレータ 21 で一連の正極 11、負極 12 をそれぞれ包むように密閉した長尺収納体 22 をジグザグに折り重ねてなる構造としたものであるから、その製作の際には、各正極 11・負極 12 間ごとに単品形態のセパレータを 1 枚ずつ積み重ねる必要がなく、また、正極 11、負極 12 それぞれを構成する「分極性電極 14 + 集電極 13 + 分極性電極 14」を該正極 11 及び負極 12 が所要数になるまで上へ上へと順に積み重ねて行く必要がなく、分極性電極 14 → 集電極 13 → 分極性電極 14 という順で上へと積み重ねる操作は正極 11 あるいは負極 12 の 1 つ分だけ行い、これを繰り返すことでよい。したがって従来と違って、単体形態部品の連続積み重ね枚数がわずかに 3 枚（分極性電極 14、集電極 13 及び分極性電極 14）で済むことで積層ずれの心配がないので、積重ね機構によってスピーディに積み重ねを行え、また、一連の正極 11、負極 12 の長尺収納体 22 を 1 区画分ずつジグザグに折り重ねるといった簡単な折り重ね操作で容易に電極積層体 20 を得ることができる。

【0026】よって、従来の、積層ずれを起こさないように時間をかけて第 1 番目から最終まで、集電極、分極性電極及びセパレータの各部品を 1 枚ずつ上へ上へと順に積み重ねてなる電極積層体 20 に比べて、生産性を向上できる。さらに、一つの長尺シート状のセパレータで一連の正極、負極をそれぞれ包むように密閉したものであるから、収納された外装ケース内での分極性電極からの活性炭遊離粉の飛散をなくすことができ、一部の正極・負極間での電氣的短絡や、漏れ電流の大幅増大による電氣的損失などの重大な品質不良の発生をなくすことができるので、電気二重層コンデンサの信頼性を高めることができる。

【0027】

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【発明の効果】以上述べたように、本発明による電気二重層コンデンサ用電極積層体によると複数の正極と複数の負極とをそれらの間にセパレータを介在させて交互に積層してなる電極積層体において、一つの長尺シート状のセパレータで一連の正極、負極をそれぞれ包むように密閉したものをジグザグに折り重ねてなる構造としたものであるから、従来のものに比べて電極積層体の生産性を向上できるとともに、収納された外装ケース内において前記正極・負極を構成する分極性電極からの活性炭遊離粉の飛散をなくすことができ、一部の正極・負極間での電氣的短絡や、漏れ電流の大幅増大などの重大な品質不良の発生をなくすことができるので、電気二重層コンデンサの信頼性を高めることができる。

【図面の簡単な説明】

【図 1】本発明による電気二重層コンデンサ用電極積層体の組立を行う組立ラインの概念図である。

【図 2】図 1 の要部の拡大図である。

【図 3】本発明による電気二重層コンデンサ用電極積層体を示す斜視図である。

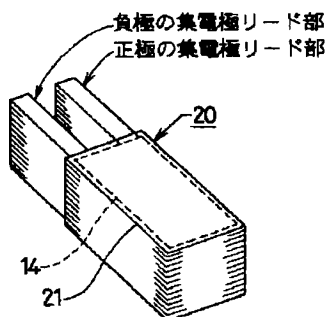
【図 4】従来の大容量電気二重層コンデンサ用の電極積層体の構成を説明するための図である。

【図 5】従来の電気二重層コンデンサ用電極積層体、及びテープで結束した該電極積層体を示す斜視図である。

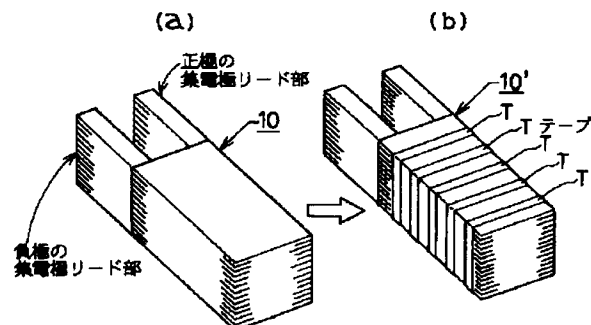
【符号の説明】

11…正極 12…負極 13…集電極 14…分極性電極 20…電気二重層コンデンサ用電極積層体 21…セパレータ 21'…セパレータ材 21' a…セパレータ材の内側水平面 22…長尺収納体 23…案内ローラ 24…長手方向折畳み機構 24 a…直角折畳み用ローラ群 24 b…折り線形成用ローラ 21 c…直角折畳み用プレート 24 d…仕上折畳み用プレート 24 e…仕上折畳み用ローラ群 25…熱シール機 25 a…サイド用熱シール機 25 b…リード部用熱シール機 26…ジグザグ折重ね機 A…積層ゾーン B…シールゾーン

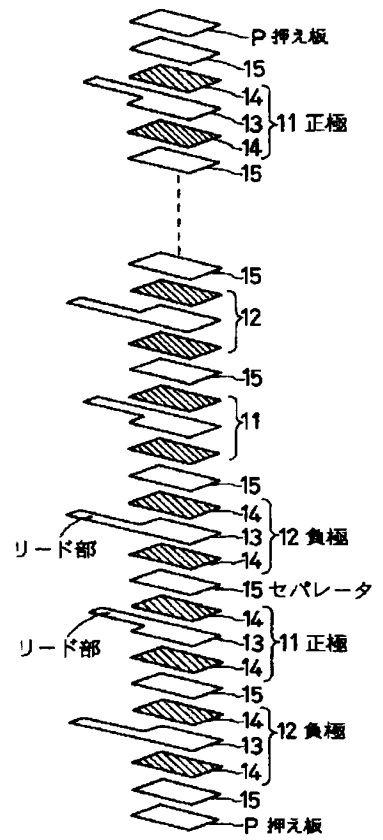
【図 3】



【図 5】



【図 4】



【図 2】

